UNIT 3

Putting It All Together

Integrating the Different Solid Waste Options

Once students understand the range of available solid waste management options—including their different purposes, benefits, and impacts—they are ready for a series of activities that utilize and reinforce their accumulated knowledge. This unit allows students to integrate the key lessons learned from previous sections and exercise decision-making and analytical skills while having fun.

CHAPTER 1

Waste in Review

Grade • Subject • Skills Index

Activity Name		Waste Race	Drop, Swap, and Roll Board Game	Trash Town
Grade Range	K			
	1			
	2	✔		
	3	✔		
	4		✔	✔
	5		✔	✔
	6		✔	✔
Subjects Covered	Math		✔	✔
	Science	✔	✔	
	Language Arts		✔	
	Social Studies	✔	✔	✔
	Art			
	Health			
Skills Used*	Communication	✔	✔	
	Reading		✔	✔
	Research			
	Computation		✔	✔
	Observation/ Classification	✔	✔	
	Problem Solving			✔
	Motor Skills	✔	✔	

*See Glossary of Skills for more details.

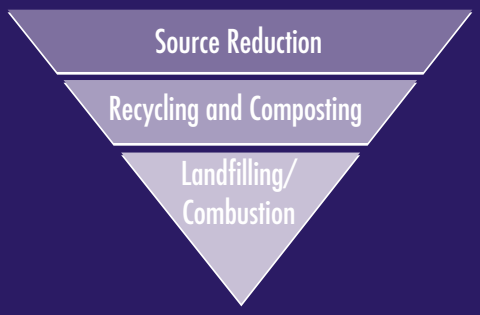
Waste in Review

Integrating all the waste management methods described in this resource has helped a growing number of communities and industries divert or reduce significant quantities of garbage from the waste stream. Successful integrated programs not only make waste management more cost-effective, but they create jobs and may even provide an economic boost to communities. Because no one method can manage all the nation's garbage, EPA recommends a waste management hierarchy that ranks the various strategies in order of priority.

EPA's Solid Waste Management Hierarchy

- Source Reduction—preventing waste is the best way to manage it!
- Recycling and Composting—converting waste into new and valuable products prevents pollution (including harmful greenhouse gases), saves natural resources, and conserves valuable landfill space.
- Landfills and Combustion—land disposal and combustion in properly managed facilities and in compliance with environmental regulations are options for the remaining waste. Energy can be generated from each of these approaches.

Solid Waste Hierarchy



Waste Generation

Waste is generated at all points in a product's life cycle—while harvesting natural resources, during design and production, and during and after use in homes, offices, and schools. Hazardous wastes, which are substances that are toxic, ignitable, corrosive, or reactive, are most often generated during extraction or production of a product, but can also come from households in the form of leftover products such as bug sprays, turpentine, motor oil, and laundry bleach. Municipal solid waste, such as old newspapers, yard clippings, empty bottles, and even whole appliances, is generated by people's everyday use of products, packaging, and materials. In the United States, each person generates nearly 4.5 pounds of solid waste per day. This figure could be reduced by placing more emphasis on source reduction.

Helping Communities' Quest for Less

Regardless of a community's size or municipal solid waste service, progress toward preferred waste management approaches can only work if individuals understand and practice the 3 R's—reducing, reusing, and recycling the solid waste they generate each day. Every member of the community can do their part by identifying

ways to prevent and recycle waste and to safely dispose of household hazardous waste. It is also important for individuals and companies to "buy recycled." After all, if no one buys recycled-content products, there's no way to close the recycling loop.

Future Goals

During the 1990s, recycling in the United States increased from 16 to 28 percent. EPA's goals for the future are to recycle 35 percent of the municipal solid waste generated by 2005; to reduce waste generation to 4.3 pounds per person per day; to empower state, local, and tribal governments to better manage solid waste; to provide leadership in source reduction and recycling; to build stronger public and private partnerships; and to ensure the environmental soundness of source reduction, recycling, combustion, and landfill disposal. The concepts learned from the activities in this resource will help lead the nation to the path of a sustainable and waste-free future.

Additional Information Resources:

Visit the following Web site for more information on all the topics discussed in this resource:

- U.S. Environmental Protection Agency (EPA) Office of Solid Waste: <www.epa.gov/osw>

science

social studies

Waste Race

Objective

To classify trash items as reusable, recyclable, compostable, disposable, or household hazardous waste.

Activity Description

Students will participate in a relay race to place trash items in appropriate bins.

Materials Needed

- A variety of trash items in each of the categories listed in Step 1, supplied by the teacher (see below for suggestions)
- Two trash bags or wastebaskets
- Two sets of colored stickers (e.g., red and blue)
- Five large plastic or metal bins

Waste Race Suggested Items (no food items please)

Napkin	Steel can	Paper lunch bag
Plastic packaging	Plastic fork	Cardboard
Piece of cloth	Aerosol can	Paint can
Glass bottle	Piece of wood	Teabag
Aluminum can	Copy paper	Coffee can
Leaves or grass	Text book	Flowers

Key Vocabulary Words

Reusable
Recyclable
Disposable
Compostable
Household hazardous
Waste

Duration

50 minutes

Skills Used

Communication
Observation/classification
Motor skills

Activity

Step 1: Review the Teacher Fact Sheets titled *Solid Waste* on page 41, *Hazardous Waste* on page 45, *Recycling* on page 73, and *Composting* on page 109 for background information. Review the different waste management options with students to put the activity in context. Discuss the different collected trash items and where they should go when they are done being used (e.g., trash, recycling bin, compost pile).

Step 2: Label five plastic bins/trash cans as "Reusable," "Recyclable," "Compostable," "Household Hazardous Waste (HHW)," or "Disposable Waste," respectively, and place them throughout the room. (This activity will work best in a large area like a gymnasium or a playground so the students have enough room to run around.) Review vocabulary with students.

Step 3: Collect trash items over a few days (see above for suggestions). Collect enough for each student to have at least one turn participating in the race. Make sure the items are not dangerous for the students to handle (e.g., no sharp edges on open cans) and they should be cleaned, if necessary. Divide the items into two piles (one for each team), labeling the Red team's items with the red stickers and the Blue team's items with the blue stickers.

Step 4: Have students form two lines/teams in the center of the room.

Step 5: Explain to the students how a relay race works. The teacher should pre-determine and announce a time limit for the race, based on the number of students and their level of familiarity with the subject. When the teacher signals for the race to start, the first student in each line will reach into his or her team's trash bag and pull out an item. The two students will decide in which bin it belongs and run to the labeled plastic bin. After placing the trash item in the bin, the student will run back to the end of the line and the next two students will repeat the same process. When the time limit has been exceeded, the teacher will end the race. The object is to be the fastest team to sort the items correctly.

Step 6: At the end of the race, empty each bin one at a time so all the students can see if the items were placed correctly. Encourage the students to discuss why each trash item was placed in its bin. Discuss whether some trash items can be placed in more than one bin. The team that was able to place the most items in the correct bin wins.

1. See Step 6.
2. Have students name an item not included in the game that is reusable, recyclable, compostable, disposable, and/or household hazardous waste.

1. Expand the Waste Race to include other classrooms and possibly a tournament for a great Earth Day activity.
2. Explore the activities found in the Planet Protector's Club kit. This kit was created by EPA as a way to get students involved in learning about their environment. It includes two pocket guides (one for adults and one for children), an official membership certificate, an official Planet Protectors Club badge, activity guides for grades K-3 and 4-6, a board game about recycling, and a Planet Protectors Club poster. To order this kit, call EPA at 800 424-9346 and ask for document number EPA530-E-98-002.

Drop, Swap, and Roll Board Game

Objective

To educate students about recycling, composting, reuse, household hazardous waste, landfilling, and combustion.

Activity Description

Students play a board game in which they must get rid of their "trash" cards by dropping off items at appropriate bins (e.g., recycling, composting, or reuse bins) stationed on the playing board. Students learn facts about waste management as they move around the board.

Materials Needed

- Several *Drop, Swap, and Roll* playing boards, with the included "trash" and "trash trivia" cards and playing pieces.
  Call EPA at 800 424-9346 to order this game at no cost while supplies last (document number EPA530-E-98-002).
- Several dice (one for each game board).

Key Vocabulary Words

Reuse
Recycling
Composting
Landfill
Incinerator
Household hazardous waste

Duration

1 hour

Skills Used

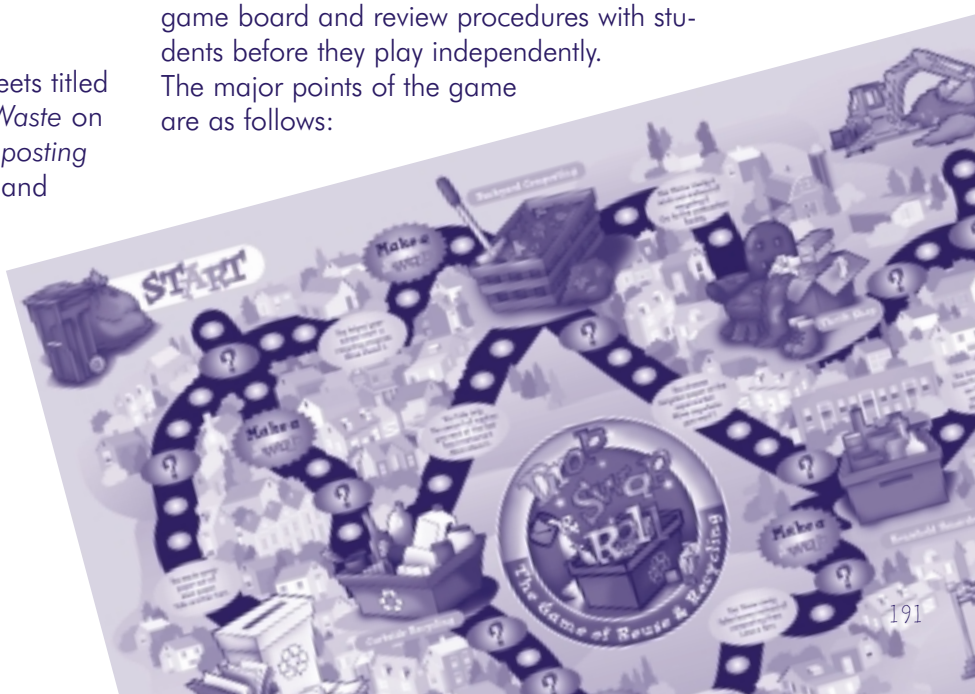
Communication
Reading
Computation
Observation/classification
Motor skills

Activity

Step 1: Review the Teacher Fact Sheets titled *Solid Waste* on page 41, *Hazardous Waste* on page 45, *Recycling* on page 73, *Composting* on page 109, *Landfills* on page 155, and *Combustion* on page 159 for background information on the different waste management options. Review vocabulary with students.

Step 2: Divide class into groups of 4 to 6 students and distribute one game board (including cards, playing pieces, and dice) to each group.

Step 3: Read instructions provided with game board and review procedures with students before they play independently. The major points of the game are as follows:



Journal Activity

Ask students to think about how they would design their community's waste management system. What would they include? How would it be different from the system their community has in place now?

Each player starts with 10 "trash" cards. A player rolls the die and moves backward or forward on the board to dispose of his or her "trash" cards in the appropriate places. Refer to the legend on the board to determine which items go where. (Some trash items might not be recycled in your community or might be handled differently than the game suggests. Explain to the students that this game can help them learn about things that are recyclable, even though they are not necessarily recycled locally.) The first player to get rid of all his or her "trash" cards is the winner.

Step 4: Players who land on a space with a question mark (?) must answer a true/false question from the "trash trivia" cards. If the player answers the question correctly, he or she gets to roll again. If he or she answers incorrectly, he or she must take another trash card from the center of the board. (The answers to some "trash trivia" cards might not reflect the practices in your community. These cards can be removed or replaced by more appropriate cards that the teacher or students can create.)

Step 5: If a player lands on a space that says "Make a Swap," he or she can get rid of any "trash" card by trading it for one from another player. Refer to the game rules for more details.

Step 6: If one player thinks another player dropped off an item at a particular location incorrectly, the first player can challenge the other player. First, check the legend to settle the dispute. If the player did drop off an item incorrectly, that player must take back his or her card and miss that turn. If that player was correct in dropping off the item (and the challenger was wrong), then the challenger must answer a "trash trivia" question. If the challenger answers incorrectly, he or she must take another "trash" card. If he or she answers correctly, the game proceeds as before. Refer to the game rules for more details.

Assessment

1. Ask students to list three items not found in the board game that can be recycled, reused, or composted in your community.
2. Have students explain why the game penalizes players by sending them to the landfill or combustor.
3. Ask students why household hazardous waste has its own station.

Enrichment

1. Ask the students to explore the different activities found on EPA's Office of Solid Waste Web site for kids <www.epa.gov/epaoswer/osw/kids.htm>. Activities include numerous games, a comic book, and a coloring book.
2. Explore the other activities found in the Planet Protector's Club kit, which is available at no cost from EPA. This kit was created by EPA as a way to get students involved in learning about their environment. In addition to the *Drop, Swap, and Roll* board game, it includes an official membership certificate, an official Planet Protectors Club badge, activity guides for grades K-3 and 4-6, and a Planet Protectors Club poster. To order this kit, call EPA at 800 424-9346 and ask for document number EPA530-E-98-002.

Trash Town

math

social studies

Objective

To teach students about the costs involved in waste management.

Key Vocabulary Words

Landfill
Tipping fee
Recycle
Disposal

Activity Description

Students will read the summary information about Trash Town and complete math problems to assess the cost of disposal and recycling in Trash Town.

Duration

1 hour

Materials Needed

- One copy of *Trash Town* worksheet per student
- One pencil per student
- One calculator per student (optional)

Skills Used

Reading
Computation
Problem solving

Activity

Step 1: Photocopy and distribute the *Trash Town* worksheet to each student. Introduce the following concepts to your class (refer to the Teacher Fact Sheet titled *Solid Waste* on page 41 for more information):

- It costs us money to dispose of our garbage. The more garbage we generate, the more money we pay for disposal.
- Landfills charge a fee for accepting trash (tipping fee).
- We can save money by recycling, composting, reusing, or source reducing instead of throwing out garbage.
- We can earn money by recycling because recycled materials can be sold to manufacturers.

The Economics of Trash

- Landfill Tipping Fee—Communities that want to dispose of their waste in a landfill must pay the landfill owners a fee, based on the number of tons of waste they discard.
- Recyclables Market—Recycling can be profitable! Communities that collect recyclable items can sell those items to manufacturers for reuse. Communities can check the recyclables marketplace to find out the current, per-ton prices associated with different recyclabe materials.

Step 2: Pass out calculators to each student. Ask the students to carefully read the *Trash Town* worksheet and complete the math problems related to the town's disposal and recycling practices. (Teachers can decide whether this worksheet should be completed in groups or individually.)

Journal Activity

Ask students to pretend that they are the mayor of Trash Town. If the residents of their town complained about the price of garbage disposal, what would they tell them?

Assessment

1. Collect the *Trash Town* worksheets and evaluate the computations and answers.
2. Ask students to identify the most expensive element of garbage disposal. Ask them whether it's more costly to recycle and reuse or to throw everything away.
3. Ask students to list some of the cost considerations involved in garbage disposal.

Enrichment

1. Conduct a "Pay-As-You-Throw" (PAYT) experiment in the classroom or lunchroom. Hand out the same amount of fake money to each student and charge them based on the amount of trash they throw away from their lunch. (One paper bag=$100, one plastic bag=$200, one aluminum can=$500, etc.) Keep this up for a few days and see if the students can bring in lunches that are less costly the next day (less wasteful). See who ends up with the most fake money at the end of the week and give that person a prize for being "waste wise." You can also explain to students that more than 4,000 communities across the country have PAYT programs where citizens are charged based on the amount of garbage they throw away.
2. Contact your local solid waste agency to obtain actual waste statistics and costs for your own community. Have students use these numbers to find out how much money the community spends on garbage disposal per day, per week, or per year.
3. Have students devise a plan for helping the residents of Trash Town save more money and protect the environment. Ask the students to write a speech or article explaining their new plan to the residents of Trash Town—what needs to be recycled and how, how the residents will benefit, and how the environment will benefit.

Answer Key

1. How many tons of garbage does the entire Trash Town generate per day? 110 tons

Per year? 40,150 tons

2. How much does it cost for Trash Town to throw all of its garbage into a landfill each year? $1,606,000

3. If Trash Town started a recycling program and recycled 30 percent of its garbage each year, how many tons of recyclables would be collected? 12,045 tons

4 If Trash Town recycled 30 percent of its garbage per year, how many tons of trash would still be sent to the landfill? 28,105 tons

5. How much money (in less tipping fees) would Trash Town save from recycling 30 percent of its garbage per year? $481,000

6. How much money would Trash Town earn from recycling 30 percent of its garbage per year? $120,450

7. How much could Trash Town earn if it started recycling 50 percent of its garbage per year? $200,750

What about 60 percent? $240,900

Welcome to Trash Town

Greetings! I'm Ruby Rubbish, the mayor of Trash Town, and I want to thank you for visiting our community. Are you good with numbers? Do you know what's best for the environment? We need your help! The residents of Trash Town are spending lots of money to haul and dump their garbage in the local landfill. Our landfill is filling up fast, and we worry about what all this trash is doing to our environment. Plus, we can't afford to keep paying so much for our garbage disposal. We've heard that other towns are helping to protect the environment by recycling and reusing items instead of throwing them away. We've also heard that some communities can make money by recycling. Unfortunately, the Trash Town garbage specialist is on vacation and we need someone to answer all of our questions about garbage disposal immediately. If I give you all of the information, can you help? If you can figure out the solutions to our questions on the next page, you'll be the hero of Trash Town!!

Trash Town Trivia

Population: 50,000

Garbage generated by each Trash Town resident per day: 4.4 pounds

Tipping fee for garbage dumped at local landfill: $40/ton

Money earned for collecting recyclables: $10/ton

Other important information

1 ton = 2,000 pounds
1 year = 365 days

Student Handout

Name: _____

1. How many tons of garbage does the entire Trash Town generate per day?

_____

Per year?

_____

2. How much does it cost for Trash Town to throw all of its garbage into a landfill each year?

_____

3. If Trash Town started a recycling program and recycled 30 percent of its garbage each year, how many tons of recyclables would be collected?

_____

4. If Trash Town recycled 30 percent of its garbage per year, how many tons of trash would still be sent to the landfill? _____

5. How much money (in less tipping fees) would Trash Town save from recycling 30 percent of its garbage per year? _____

6. How much money would Trash Town earn from recycling 30 percent of its garbage per year?

_____

7. How much could Trash Town earn if it started recycling 50 percent of its garbage per year?

_____

What about 60 percent? _____

CHALLENGE CORNER

Can you face the Trash Town challenge? The following information will help you solve the word problems below.

Different types of recycled materials earn different amounts of money in the recyclables marketplace. For example:

Plastic bottles: $15/ton	Cardboard: $40/ton	Magazines: $5/ton	Steel: $40/ton
Aluminum cans: $40/ton	Newspaper: $15/ton	Glass: $15/ton	

1. How much money would Trash Town earn for recycling 250 tons of newspaper and 30 tons of steel per year? _____

2. If Trash Town recycles 20 percent of its total annual garbage and 15 percent of that garbage is aluminum cans and 5 percent is magazines, how much money will it earn in total? _____

3. How many pounds of cardboard would Trash Town have to recycle in order to earn more than $39,000 per year? _____